MANAGEMENT OF NATIVE STANDS OF THE OSTRICH FERN

-Discussion Paper-

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INTRODUCTION

N.B. may have as many as 5,000 acres of ostrich fern, of which only 600-900 acres are regularly harvested. The market for the croziers (fiddleheads) of the ostrich fern has been strong with insufficient quantities to meet processing requirements and to allow the development of a regional fresh market. Harvesting from the native stands is limited by access to remote areas, insufficient harvesters and brief harvesting season.

There is some indication that the productivity of natural stands can be raised considerably by providing management and control over these areas. There has been considerable interest on the part of landowners in managing and improving their stands of ostrich fern. In response to this interest, the following comments and guidelines have been developed based on the information presently available.

Factors Affecting Yield on Native Stands:

1) Soil Type: Although the ostrich fern can be found on a wide range of alluvial soil types, it appears to be more productive on the coarser types provided moisture is not limiting. In N.B. the largest crowns and densest stands are found in the sand and gravel based Riverbank soils of the Kedgwick and Restigouche rivers respectively. Similar

growth can be found on a number of other streams with alluvial sands such as the Nashwaak and the Kennebecasis. In contrast, the lower Saint John River, with its heavy silt loams does not appear to be as capable of producing productive stands of the ostrich fern. On these soils, both the size of crown (and croziers) and the population density is reduced.

2) Annual Soil Deposits: Any area which receives an annual deposit of 0.5 cm or more of new soil from spring freshets will be more productive. This is due to the growth habit of the perennial crown of the ostrich fern. The crown is an upright rhizome which grows 0.5-2.0 cm per year. From this rhizome Adventitious roots are produced directly behind the current year's fronds. The deposit of soil each year allows the development of these new roots and the continual replacement of the old root system. If no deposit of soil occurs, the crown apex, after very few years, is too far above ground to allow new roots to develop. The plant must then rely on the older root system. Under this situation, the crown rapidly declines in vigor, and longevity is greatly reduced.

In addition, the development of new rhizomes from the crown is reduced in the same manner as the roots if not supplied with new soil about the crown.

3) Organic Deposits: The requirement discussed above can be replaced by a regular deposit of organic debris or mulch. The organic material will provide the necessary medium to allow for new root development. One of the most productive sites studied to date is supplied with an annual deposit of organic material and little or no mineral deposition.

In addition both mineral and organic deposits must contribute significantly to the nutrition of the Ostrich fern and is in part responsible for the improved vigor of crowns in these areas. The magnitude of this contribution is not known at present.

4) Light: There are still many questions regarding the light requirement of the ostrich fern. It has been demonstrated that full sunlight will reduce growth by at least 20%. (Dykeman, 1981). On the other hand, field observations would indicate that heavy shade results in reduced growth and eventual loss of the ostrich fern. Excluding the extremes, field observations show that the ostrich fern can be productive over a wide range of shade situations. Several locations where the ferns are shaded only in the early morning and/or late afternoon have proven very productive. On the other hand, stands which have a fair overstory of deciduous hardwood have also proven productive.

From the standpoint of management, a minimum amount of unproductive growth to work around and to compete with the ferns would be desirable.

5) Moisture: Because of the morphological features of its foliage, one would expect the ostrich fern to have a high transpiration rate and large moisture requirement. In addition the ostrich fern root system is very shallow and non-extensive, and therefore is not very effective in foraging for moisture. As a result of these two features, it would appear natural to find the ostrich fern in low lying areas on wet soils. Such is not the case.

In fact, the ostrich fern will not tolerate poorly drained soils. It demands a soil with good aeration properties. Examples are countless in the wild which show the decline in vigor and density of the ostrich fern as soil becomes more poorly drained. The edge of ostrich fern stands stop abruptly near low lying areas which remain water saturated much of the time (being replaced in these areas by the Sensitive fern, Onoclea sensibilis). In contrast, the ostrich fern will extend its territory into droughty soils. Vigor of the ostrich fern on these dry soils is usually reduced considerably but the stands are very persistent, often having a high crown density.

Because of its natural habitat which provides both shade and protection from wind, the moisture requirement of the plant may be considerably less under natural conditions than one would expect. However, it is quite evident that the ostrich fern does require a steady moisture supply for maximum growth. This is usually met by having a well drained soil but with good moisture holding capacity and/or a relatively high water table.

6) Competition: The ostrich fern because of its extensive foliage and height is very competitive with other herbaceous and grass species Under conditions which favour the development of dense, tall ferns, the ostrich fern will overcome all other species. Under more marginal conditions, the ostrich fern can have problems competing with some tall growing species such as Solidago (Goldenrods), Ribes (Brambles) and Eupatorium (Joe pie weeds) species. These three generally are high light requiring plants and will usually have the edge under full sunlight conditions. In addition, the ostrich fern cannot compete with advancing Alnus (alder). This situation only occurs however, when shade or overstory has been removed, favoring the establishment of alders.

Genetic Variability: Like most plant species, the ostrich fern population contains a broad base of genetic variability. Factors which have been shown to be affected by this variability include vigor, size, rate of rhizome development, and time of emergence and light tolerance (Dykeman, 1981b)). While this variability offers good potential for the selection of high producing clones, it does little for the individual trying to manage existing stands of the ostrich fern. The genetic material in an area will have an overriding effect on the potential productivity of that area regardless of the factors previously discussed and regardless of any management practices.

7) Frost: The emerging croziers and the fronds of the ostrich fern are extremely sensitive to freezing temperatures. Frost damage is common throughout most fiddlehead areas in N.B.

The normal fiddlehead habitat is flat and low lying, thus has little air drainage away from the area. Such areas are very prone to radiation frosts in the spring of the year. The frost risk of an area will depend on the extent of overstory. the proximity to large bodies of water, and the surrounding topography.

The critical temperatures and duration required to cause frost injury on fiddleheads is yet unknown. They are clearly as sensitive as other horticultural crops such as asparagus. Only slight damage renders the crozier unmarketable and will prevent its normal emergence and growth. Loss of the first flush of croziers from frost represents a 50-80% loss of potential crop. The salvation on native stands is the variable emergence of crowns due to genetic variability and to location of crowns.

8) Population Density: Yield potential of a natural stand will be directly proportional to the crown density. It should be noted that there is no correlation between crown (and crozier) size and crown density within the naturally occurring densities of 1-30 crowns per m^2 (Dykeman, 1979). Therefore, it is possible to find or to encourage both very large productive crowns and high crown densities.

High crown densities are found naturally under conditions of annual soil or organic deposition and in coarser soil types. Low densities appear common in heavier soils and under conditions of heavy shade.

9) Crown Size: The diameter of the crown, height of frond, crozier size and mass are positively correlated (Dykeman, 1982). Therefore the development of large vigorous crowns is desirable to maximize yields. Factors already discussed which positively affect crown vigor are annual deposition, light to moderate shade and adequate soil moisture.

Yield Potential On Native Stands

The yield of fiddleheads from native stands will vary from a few hundred kilograms per hectare to 2,500 kg/ha depending on location, soils, moisture, shade, crown density and vigor. Roberts-Pichette (1972) recorded yields of 800 to 2,000 kg/ha from solid island stands in the Saint John river. One semi-managed native stand currently being studied recorded 3,000 kg/ha in 1982. It must be realized these yield figures are from samples within a stand, and therefore reflect solid stand yields; not the yield to be expected from large areas with just patches of fiddleheads throughout.

The potential yield for native stands will be entirely dependent on those factors discussed earlier; soil type, deposition, shade, moisture, frost occurrence, competition and genetic variability. The two factors having possibly the greatest impact on yield potential are those two which cannot be altered significantly by management, namely soil type and genetic variability. The ideal ostrich fern stand would contain 250,000 crowns/ha (120,000 crowns/acre) with a frond height of 1.5 - 1.8 m and would yield 6,000 kg/ha.

To project a potential yield of a given stand or area cannot be done without first evaluating the site from the stand point of factors discussed and the possible improvements that can be made. However, a general statement will be made that most stands can be brought to the 2,000 kg/ha level provided the original stand produces fronds 1.2 m or greater in height.

Approaches For Management

It must be stressed that no research has been directed toward the management of native stands. Therefore, the following discussion is not based on proven information. It is designed to identify areas where management may impact on the productivity of existing stands and to stimulate interest in developmental activity at the farm level.

Because research has not been carried out, the end result of management initiatives cannot be accurately defined, nor can yield potentials be accurately projected. For this reason, one must be cautious in committing resources to such a project. A reasonable limit to investment in such a project would be the level of return currently realized from the area being committed to management.

1. Site analysis: In order to determine if a site warrants investment of time and resources, or whether there is any reason to think improvements can be made to a stand, a very thorough study of the area should be made. The points to consider in this analysis are:

a) current growth of ostrich fern, i.e. the density and the vigor of the existing crowns. Record the harvest from the area, establish the size of the stand, determine average crown density in the stand.

b) Deposition and flood characteristics - Does the area flood annually? Does it leave a deposit of soil or organic debris? Does the area flood throughout the summer? Does the area wash or is there a potential that the area might erode if larger growth is removed?

c) Weed situation and overstory. Is the area heavily shaded? What is the weed competition within the stand and surrounding the stand?

d) Soil type and drainage - What is the soil texture, clay, silt, sand or gravel? Does the area drain rapidly in the spring? Does the sensitive fern (Onclea sensiblis) co-exist with the ostrich fern (wet soils) or do grasses prevail as competitors (well drained soil)? What are the opportunities to drain low lying areas?

e) Frost - What is the record of occurrence of frost during the harvest period?

f) Expansion potential - What is the site potential for expanding the present size of the stand?

g) Ease of control - can access to the area be satisfactorily controlled at harvest time?

The information gained in the site analysis will be required in order to make decisions on the following management areas.

2. Overstory Removal. In many cases native stands will benefit from the thinning out of overstory and a reduction in shading levels. Exceptions to this may be areas where elm was a major component of the overstory but has been removed in recent years because of disease. In these cases, shading has been reduced naturally.

There are, however, major precautions which must be considered in this area. If the density of crowns is currently less than $10/m^2$, overstory must be removed very gradually so as not to encourage the establishment of perennial weeds and grasses. Only when the density of crowns is such that they will suppress weed competition can overstory be extensively removed. At present, 75% of full sunlight is suggested as a target over time.

If competition from perennial weeds and grasses currently exists no shade reduction should be attempted. In fact, an increase in shading may assist the ostrich fern in gaining control of the area.

A second precaution in this area is the effect of large tree removal on water movement at flood time, on mineral and organic deposition and on erosion. There may even be advantages to planting additional trees in some areas to gain better control of flood waters.

3. Mulching: Where annual deposits of mineral soils or organic matter does not occur, mulching should be considered. This is essential in order to extend crown life, and to encourage higher crown densities and more rapid spreading of the ferns.

The use of organic mulches is most satisfactory where regular spring or summer flooding does not occur. Flooding tends to lift newly applied organic material. Virtually any source of organic matter can be utilized, such as sawdust, chips, shavings, hay or straw and bark. An application of 3-5 cm of sawdust or chips should be satisfactory for 3 to 5 years. One solution to the problem of mulch losses at flooding is to apply hay or straw following the spring freshet, prior to fiddlehead emergence. In this way the fronds emerge through the mulch. In the fall the fronds collapse on the mulch holding it in place in subsequent freshets. However, timing and soil conditions would allow this operation only in very few situations.

4. Competition Control: Because fiddleheads are a new crop to agriculture, there are presently no chemicals registered for use on them. However, work has been proceeding to screen a range of herbicides for use with this crop. In the interim there is considerable action that an individual can take to reduce competition for the ostrich fern.

The first species to be removed should be the woody shrub species such as, alders, dogwoods, willow, poplar and seedlings of maple, etc. These species can be controlled at any time of the year by cutting and treating the freshly cut bases with a brush herbicide. Again, removal of these shrub species should only be done in areas which will not adversely affect water movement or deposition characteristics.

If registration is obtained, it appears that many of the annual, biennial and perennial herbaceous weeds and grasses can be suppressed or controlled by the use of Simazine and glyphosate in the early spring or late fall when the crowns are dormant.

In fringe areas where few crowns exist and perennial weeds are extensive it may be advantageous to remove all growth initially with the use of foliar sprays of 2,4-D or glyphosate. These areas can then be replanted with crowns. (If transplanting is to take place, do not apply 2,4-D to soil surface.)

5. Transplanting: Transplanting of crowns may be desirable to achieve solid stands and to expand the margins of the stand. Before transplanting, weeds must be controlled. This can be done by treating the entire area or by spot or strip spraying with glyphosate when vegetation is actively growing.

Transplanting must be done when the crown is dormant, either in early spring or after frost in September and October. Young crowns from known productive clones or patches can be used as planting stock. In the near future, plants of selected clones may be available. When digging plants for replanting, care must be taken to obtain only young crowns with a good root system. Roots must be protected from drying out until they can be replanted.

When replanting, place the plant in the soil to a depth that will just cover the top of the dormant crown. This usually means planting the crown, 5-8 cm deeper than its original depth. This will ensure adequate soil for new root development for several years.

A reasonable planting density would be 1-2 crowns per m^2. This should provide the desired stand density within four years.

6. Fertility: Virtually nothing is known, to date, on the nutritional requirements of the Ostrich fern. No attempt should be made to fertilize native stands until crown densities exceed 10 per m^2 and all weed competition has been suppressed. To do otherwise is likely to encourage weed growth.

7) Frost: It should be realized that the removal of overstory will increase the risk of radiation frosts in the spring. If stands are located in a high risk area, some means of frost control should be considered. For fiddleheads, the most suitable means may be a system of smudge burners.

8) Harvesting: The Ostrich fern crown in the spring contains all the croziers for the next four years of growth. If too many croziers (fiddleheads) are removed, croziers destined for the following year will be forced to grow. This situation will result in reduced production and vigor in subsequent years. At present, a final answer is not available on the number of croziers which can be removed without reducing crown vigour. However, it is suggested that up to eight (8) croziers can be harvested annually. This number should be reduced for young crowns.

This usually translates into 2 harvests per crown per season. The first flush of growth in the spring will generally yield 4-6 croziers followed by a second flush of 2-4 croziers which will give the desired eight croziers per crown.

Harvesting pressure may have to be adjusted based on the performance of a stand from year to year.

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